RICE Group Chair/Co-Chair

ICCR RICE Source Work Group

Attached is a table entitled HAPs Selection and Test Methods for digester gas fired Reciprocating internal combustion engines. The list contains the names of the 189 Hazardous Air Pollutants (HAPs) that have, based on experience, been screened for potential presence in emissions from digester gas fired RIC engines. This preliminary screening has been performed on the list by the Testing and Monitoring Protocol Work Group (TMPWG). This table is being forwarded to the RICE Source Work Group (SWG) for review and comment.

The table includes HAPs that may be present in these emissions. Additionally, a listing of testing methods that have been used and have the potential to quantify the HAPs presence in flue gas emissions are included.

For those HAPs that are not included in the list, a codified reason for their exclusion is provided. Exclusion codes include:

1- Compound is not expected to be emitted from source because basic chemical or physical principles do not favor its existence in source exhaust.

2 - Existing test data indicate that compound is not emitted in significant quantities from source.

Other exclusion codes are included as appropriate.

It should be noted that this table is general in its first draft and represents the extent of the TMPWG's knowledge and experience with emissions from digester gas fired RIC engines. Please review carefully from a standpoint of those HAPs included as well as those HAPs excluded. The subgroup within the TMPWG that is responsible for the development of this table has included a preface that provides the sources of information utilized to develop the table, the rationale for exclusion codes, and the names of the TMPWG contact for the RICE SWG.

If we can be of service in any other fashion or if you have any questions concerning in the table, please contact William Passie(e-mail: "passie_william_c@cat.com") the TMPWG member who is monitoring the activities of your SWG.

Rationale for Compound Selection for Reduced Hazardous Air Pollutant (HAP) List

Source Category: Reciprocating Internal Combustion Engines (digester gas fired)

A. Source of information used in the development of reduced HAP list table

The attached target list of 9 HAPs, emitted from RICE burning digester gas at Publicly Owned Treatment Works, was prepared based on: 1) California experience with toxic air regulations such as AB 2588 and, 2) Actual source test results. These two approaches are briefly described in the following.

1. In California, the Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) was implemented on June 1, 1989. This law requires facilities with air toxic emissions to self report emissions in order to determine if "hot spots" exist in the state.

To comply with the requirements of AB 2588 at wastewater treatment plants, the City of Los Angeles (CLA) developed a reduced list of 16 compounds for quantification and reporting purpose. AB 2588 requires quantification of over 150 compounds if they are emitted at a reporting facility in excess of "quantification threshold" in pounds per year. For preparing the reduced or "target list" of 16 compounds for the combustion sources, CLA used historical influent monitoring at the plant, data on VOC found from other POTWs, pooled emission estimation program (PEEP), and literature. In addition, ducted headworks were source tested for air and liquid samples collected at the plant infl

2.The HAP list was reduced further from 16 to 9 compounds after review of actual source test results and identifying compounds found in significant quantities above the detection levels. Most of the source testings were performed to comply with air toxics regulations such as AB2588.

B. Rationale for the exclusion codes and number of compounds included in the reduced HAP list table

For preparation of a reduced HAP list for the digester gas fired RICE, compounds were excluded based on following exclusion codes:

1- Compound is not expected to be emitted from source because basic chemical or physical principles do not favor its existence in source exhaust.
2- Existing test data indicate that compound is not emitted in significant quantities from source.
3- Other
4- Compounds not expected to be emitted from POTW sources based on CLA (1991) and PEEP (1990) target lists.

The attached draft list of HAPs and Test Methods for RICE is an attempt to produce a more manageable list for the reviewer of the RICE SWG. It is hoped that latter will find the reduced HAP list useful in setting cost-effective national MACT standards.

If you have any questions concerning in the table, please contact Farhana Mohamed, the TMPWG

member who developed the attached table.

C. References

a) City of Los Angeles, Department of Public Works, Bureau of Sanitation. (1991) Final Emissions Inventory Report, City of Los Angeles Air Toxics Program, AB 2588 - Air Toxics "Hot Spots" Information and Assessment Act of 1987, Terminal Island Treatment Plant, San Pedro, CA.

b) Joint Power Agencies for Pooled Emission Estimation Program. (1990) Final Report for POTWs on Air Toxics "Hot Spots" Information and Assessment Act of 1987.

c) Sanitation Districts of Los Angeles County. (1991) Report for AB 2588 - Air Toxics “Hot Spots” information and Assessment Act of 1987, Joint Water Pollution Control Plant, Carson, CA.

HAPS Selection and Test Methods for Source Category				
Source Category:		RIC Engines (digester gas fired)		
Include i n			If excluded , give reaso n	If included give
List?	CAS No.	Chemical name	for exclusio n	applicable test method(s)
	75070	Acetaldehyde	2	
	60355	Acetamide	2,4	
	75058	Acetonitrile	2,4	
	98862	Acetophenone	2,4	
	53963	2-Acetylaminofluorene	2,4	
x	107028	Acrolein		CARB 430
	79061	Acrylamide	2,4	
	79107	Acrylic acid	2,4	
	107131	Acrylonitrile	2,4	
	107051	Allyl chloride	2,4	
	92671	4-Aminobiphenyl	2,4	
	62533	Aniline	1,2,4	
	90040	o-Anisidine	1,2,4	
	1332214	Asbestos	1,2,4	
x	71432	Benzene		EPA TO-14/CARB 422
	92875	Benzidine	2,4	
	98077	Benzotrichloride	2,4	
	100447	Benzyl chloride	2,4	
	92524	Biphenyl	2,4	
	117817	Bis(2-ethylhexyl)phthalate (DEHP)	2,4	
	542881	Bis(chloromethyl)ether	2,4	
	75252	Bromoform	2,4	
x	106990	1,3-Butadiene		EPA TO-14/CARB 422
	156627	Calcium cyanamide	1,2,4	
	133062	Captan	2,4	
	63252	Carbaryl	2,4	
	75150	Carbon disulfide	2	
	56235	Carbon tetrachloride	2	
	463581	Carbonyl sulfide	2,4	
	120809	Catechol	2,4	
	133904	Chloramben	2,4	
	57749	Chlordane	2,4	
	7782505	Chlorine	2,4	
	79118	Chloroacetic acid	2,4	
	532274	2-Chloroacetophenone	2,4	
	108907	Chlorobenzene	2,4	
	510156	Chlorobenzilate	1,2,4	
	67663	Chloroform	2	
	107302	Chloromethyl methyl ether	2,4	
	126998	Chloroprene	2	
	1319773	Cresols/Cresylic acid (isomers and mixture)	2,4	
	95487	o-Cresol	2,4	
	108394	m-Cresol	2,4	
	106445	p-Cresol	2,4	
	98828	Cumene	2	
	94757	2,4-D, salts and esters	2,4	
	3547044	DDE	2,4	
	334883	Diazomethane	2,4	
	132649	Dibenzofurans	2,4	
	96128	1,2-Dibromo3-chloropropane	2,4	
	84742	Dibutylphthalate	2,4	
	106467	1,4-Dichlorobenzene(p)	2	
	123911	1,4-Dioxan e	2	

HAPS Selection and Test Methods for Source Category				
Source Category:		RIC Engines (digester gas fired)		
Include i n			If excluded , give reaso n	If included give
List?	CAS No.	Chemical name	for exclusio n	applicable test method(s)
	91941	3,3-Dichlorobenzidene	1,2,4	
	111444	Dichloroethyl ether (Bis(2-chloroethyl)ether)	2,4	
	542756	1,3-Dichloropropene	2,4	
	62737	Dichlorvos	1,2,4	
	111422	Diethanolamine	2,4	
	121697	N,N-Diethyl aniline (N,N-Dimethylaniline)	2,4	
	64675	Diethyl sulfate	2,4	
	119904	3,3-Dimethoxybenzidine	2,4	
	60117	Dimethyl aminoazobenzene	2,4	
	119937	3,3--Dimethyl benzidine	2,4	
	79447	Dimethyl carbamoyl chloride	2,4	
	68122	Dimethyl formamide	2,4	
	57147	1,1-Dimethyl hydrazine	2,4	
	131113	Dimethyl phthalate	2,4	
	77781	Dimethyl sulfate	2,4	
	534521	4,6-Dinitroo-cresol, and salts	2,4	
	51285	2,4-Dinitrophenol	2,4	
	121142	2,4-Dinitrotoluene	2,4	
	122667	1,2-Diphenylhydrazine	2,4	
	106898	Epichlorohydrin (l-Chloro-2,3-epoxypropane)	2,4	
	106887	1,2-Epoxybutane	2,4	
	140885	Ethyl acrylate	2,4	
	100414	Ethyl benzene	2	
	51796	Ethyl carbamate (Urethane)	2,4	
	75003	Ethyl chloride (Chloroethane)	2,4	
	106934	Ethylene dibromide (Dibromoethane)	2,4	
	107062	Ethylene dichloride (1,2-Dichloroethane)	2	
	107211	Ethylene glycol	2,4	
	151564	Ethylene imine (Aziridine)	2,4	
	75218	Ethylene oxide	2,4	
	96457	Ethylene thiourea	2,4	
	75343	Ethylidene dichloride (1,1-Dichloroethane)	2,4	
x	50000	Formaldehyde		CARB 430
	76448	Heptachlor	2,4	
	118741	Hexachlorobenzene	2,4	
	87683	Hexachlorobutadiene	2,4	
	77474	Hexachlorocyclopentadiene	2,4	
	67721	Hexachloroethane	2,4	
	822060	Hexamethylene-1,6-diisocyanate	2,4	
	680319	Hexamethylphosphoramide	2,4	
	110543	Hexane	2,4	
	302012	Hydrazine	2,4	
	7647010	Hydrochloric acid	2,4	
	7664393	Hydrogen fluoride (Hydrofluoric acid)	2,4	
	7783064	Hydrogen sulfide	2,4	
	123319	Hydroquinone	2,4	
	78591	Isophorone	2,4	
	58899	Lindane (all isomers)	2,4	
	108316	Maleic anhydride	2,4	
	67561	Methanol	2,4	
	72435	Methoxychlor	2,4	
	74839	Methyl bromide (Bromomethane)	2,4	
	74873	Methyl chloride (Chloromethane)	2	

HAPS Selection and Test Methods for Source Category				
Source Category:		RIC Engines (digester gas fired)		
Include i n			If excluded , give reaso n	If included give
List?	CAS No.	Chemical name	for exclusio n	applicable test method(s)
	71556	Methyl chloroform (1,1,1-Trichloroethane)	2	
	78933	Methyl ethyl ketone (2-Butanone)	2	
	60344	Methyl hydrazine	2,4	
	74884	Methyl iodide (Iodomethane)	2	
	108101	Methyl isobutyl ketone (Hexone)	2	
	624839	Methyl isocyanate	2,4	
	80626	Methyl methacrylate	2,4	
	1634044	Methyl tert butyl ether	2	
	101144	4,4-Methylene bis(2-chloroaniline)	2,4	
x	75092	Methylene chloride (Dichloromethane)		EPA TO-14/CARB 422
	101688	Methylene diphenyl diisocyanate (MDI)	2,4	
	101779	4,4--Methylenedianiline	2,4	
	91203	Naphthalene	2,4	
	98953	Nitrobenzene	2,4	
	92933	4-Nitrobiphenyl	2,4	
	100027	4-Nitrophenol	2,4	
	79469	2-Nitropropane	2,4	
	684935	N-Nitroso-Nmethylurea	2,4	
	62759	N-Nitrosodimethylamine	2,4	
	59892	N-Nitrosomorpholine	2,4	
	56382	Parathion	1,2,4	
	82688	Pentachloronitrobenzene (Quintobenzene)	1,2,4	
	87865	Pentachlorophenol	2,4	
	108952	Phenol	2,4	
	106503	p-Phenylenediamine	2,4	
	75445	Phosgene	2,4	
	7803512	Phosphine	2,4	
	7723140	Phosphorus	2,4	
	85449	Phthalic anhydride	2,4	
	1336363	Polychlorinated biphenyls (Aroclors)	2,4	
	1120714	1,3-Propane sultone	2,4	
	57578	beta-Propiolactone	2,4	
	123386	Propionaldehyde	2,4	
	114261	Propoxur (Baygon)	1,2,4	
	78875	Propylene dichloride (1,2-Dichloropropane)	2,4	
	75569	Propylene oxide	2,4	
	75558	1,2-Propylenimine (2-Methyl aziridine)	2,4	
	91225	Quinoline	2,4	
	106514	Quinone	2,4	
	96093	Styrene oxide	2,4	
	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1,2,4	
x	127184	Tetrachloroethylene (Perchloroethylene)	2,4	EPA TO-14/CARB 422
	7550450	Titanium tetrachloride	1,2,4	
	100425	Styrene	2	
x	108883	Toluene		EPA TO-14/CARB 422
	95807	2,4-Toluene diamine	2,4	
	584849	2,4-Toluene diisocyanate	2,4	
	95534	o-Toluidine	2,4	
	8001352	Toxaphene (chlorinated camphene)	2,4	
	120821	1,2,4-Trichlorobenzene	2	
	79005	1,1,2-Trichloroethane	2,4	
x	79016	Trichloroethylene		EPA TO-14/CARB 422
	95954	2,4,5-Trichlorophenol	2,4	

HAPS Selection and Test Methods for Source Category				
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Include i n			If excluded , give reaso n	If included give
List?	CAS No.	Chemical name	for exclusio n	applicable test method(s)
	88062	2,4,6-Trichlorophenol	2,4	
	121448	Triethylamine	2,4	
	1582098	Trifluralin	1,2,4	
	540841	2,2,4-Trimethylpentane	2,4	
	108054	Vinyl acetate	2	
	593602	Vinyl bromide	2,4	
	75014	Vinyl chloride	2	
	75354	Vinylidene chloride (1,1-Dichloroethylene)	2	
x	1330207	Xylenes (isomers and mixture		EPA TO-14/CARB 422
	95476	o-Xylenes	2	
	108383	m-Xylenes	2	
	106423	p-Xylenes	2	
	N/A	Antimony Compounds	1,2,4	
	N/A	Arsenic Compounds (inorganic including arsine	1,2,4	
	N/A	Beryllium Compounds	1,2,4	
	N/A	Cadmium Compounds	1,2,4	
	N/A	Chromium Compounds	1,2,4	
	N/A	Cobalt Compounds	1,2,4	
	N/A	Coke Oven Emissions	1,2,4	
	N/A	Cyanide Compounds *1	1,2,4	
	N/A	Glycol ethers *2	1,2,4	
	N/A	Lead Compounds	1,2,4	
	N/A	Manganese Compounds	1,2,4	
	N/A	Mercury Compounds	1,2,4	
	N/A	Fine mineral fibers *3	2,4	
	N/A	Nickel Compounds	1,2,4	
	N/A	Polycylic Organic Matter *4	2,4	
	N/A	Radionuclides (including radon) *5	1,2,4	
	N/A	Selenium Compounds	1,2,4	